

# **MODIS DATA STUDY TEAM PRESENTATION**

**February 1, 1991**

## **AGENDA**

1. Action Items
2. Snow Cover Algorithm Activities
3. Proposal Review Plan
4. Land Science Proposals, Phase I: Justice, Huete, Vanderbilt, Wan, and Running
5. Preliminary Level-1B Context Diagram
6. Preliminary Level-1B Data Flow Diagrams and Data Dictionary

#### **ACTION ITEMS:**

11/16/90 [Doug Hoyt]: Review MODIS Level-1 data flow diagrams and identify data items potentially provided by the MCST. Provide a list of instrument parameters required to Earth locate MODIS pixels (e.g. detector locations, electronic delays, mirror rotations, etc). STATUS: Presently available information insufficient to address item. Report due approximately one year from the assignment date. Open.

12/21/90 [Watson Gregg and Al McKay]: Combine Earth Model reports into single document. Pursue 2 additional questions: 1) how important is the geoid/spheroid difference over the oceans, and 2) how important is the difference over land, considering the types of DEM/DTM's likely to be used? Coordinate with Al Fleig to distribute report. STATUS: A conversation has been held with Bob Evans (oceans), who said he preferred the geoid. A discussion with Chris Justice (land) was also held. He requested a short write-up on the issue be sent to himself and Muller and Barnsley so they could form an informed opinion. Open.

12/21/90 [Daesoo Han]: Arrange a meeting (Preliminary Design Review) with appropriate EOSDIS civil service personnel to discuss the MODIS Level-1A data system design, including data processing services to be provided on each side of the EOSDIS/MODIS interface. STATUS: Meeting held January 18, 1991. Closed.

SNOW COVER ALGORITHM ACTIVITIES  
IN SUPPORT OF V. SALOMONSON AND D. HALL

Activities to be done are outlined below. Task is to assist in development of snow cover mapping algorithms and snow/cloud discrimination algorithms. Initial efforts will be to get TM images of snow covered, and snow and cloud covered areas placed on the LTPCF, then begin development and testing of algorithms. An important activity is to communicate and collaborate with NOAA efforts to develop global snow products.

Inventory of current TM imagery, and assessment for use in determining snow cover and/or testing snow/cloud discrimination algorithm.

Load selected TM imagery onto the computer system.

Develop snow cover algorithms, and snow/cloud discrimination algorithm(s) using the 1.6  $\mu\text{m}$  wavelength for discriminating snow/cloud. The basic concept of snow/cloud discrimination at 1.6  $\mu\text{m}$  is that reflectance from snow falls drastically to less than 50% on non-snow surfaces; it also is much less than cloud reflectance. Research snow cover and snow/cloud reflectance properties and algorithms presented in the literature, and maintain a bibliography. Evaluate the algorithms; how do they perform? In what conditions do they not perform? Can mapping or discrimination be enhanced with other reflectance features? MODIS may have better discriminating capabilities with increased numbers of bands and possible analysis of spectral feature differences.

Search the Landsat holdings for images that could be used to further test algorithms after initial evaluations of how the algorithms are performing.

Contact NOAA concerning their operational snow mapping products and procedures, and snow/cloud discrimination. Communicate with them to share expertise.

## PLAN FOR REVIEW OF EXECUTION PHASE PROPOSALS

- Phase 1.** Read proposals, fill in Data Requirements Form with information contained in proposals. This should be a verbatim rendering of what the scientists said in the proposal -- it includes no interpretation or derivation.
- Phase 2.** Summarize information in proposals. Compare information to previous estimates of data requirements.
- Phase 3.** Produce updated data requirements statement.

**MODIS Team Member Proposal  
Data Requirements Form**

---

**Investigator:** Justice

---

**Output Product(s):**

- (1) Vegetation Index
- (2) Atmospherically-Corrected Land-Leaving Radiance (supporting role to Kaufman and Tanre). Present effort is development and testing in selected environments
- (3) Fire Product (supporting role to Kaufman)
- (4) Land Cover Inventory
- (5) Spatial Heterogeneity Utility Algorithm (supporting role to Strahler)

**Resolution (Time):**

**(Space):**

**Domain (Space):** global

---

**At/Post-Launch:** At

---

**MODIS-N/T:** N

---

**Input Data:** (1) Topographically-corrected Level-1B bands

**Spectral Bands Required:**

**Resolution (Time):**

**(Space):** 214 m (250 m) bands

(5) 214 m (250 m), 428 m (500 m), 856 m (1000 m) bands

---

**Ancillary Data Required (Type and Source):**

**Pre-Launch:**

**Size (Mbytes):**

- (1) AVHRR, TM, MSS data for selected regions
- (2) AVHRR and TM data across the Sahel  
NASA Aircraft data as defined
- (3) AVHRR, Landsat, and SPOT data for Brazil and Central Africa. Also simulated MODIS data for the "fire channels"  
NASA Aircraft data as defined
- (5) TM data

Aircraft data will be defined  
Ground data will be defined

**Post-Launch:**

**Size (Mbytes):**

---

**Algorithm Complexity (floating point operations/scan):**

---

**Algorithm Memory Required (Mbytes):**

---

**Data Storage Required (Mbytes/scan):**

---

**Look-Up Tables Required:**

**Size (Mbytes):**

---

**Lines of Code:**

---

**Language Expected:** GIMMS AVHRR processing chain will be re-written  
into UNIX.

---

**Accessory Output Products (e.g., field experiment data):**

**Pre-Launch:**

**Size (Mbytes):**

**Post-Launch:**

**Size (Mbytes):**

---

**Expected Need of SDST (Pre- or Post-Launch):** Role of effort is to design, test, and provide algorithms for data products and assist in development of code and data processing sequence required for operational data processing. Responsibility for producing and distributing data on an operational basis will be handed over to the MODIS facility. Proposer is responsible for developing and testing the algorithms, providing a description of the processing steps, and for validating the data product.

---

**Post-Launch Expected Growth:**

---

**Quality Assessments:** Will be the responsibility of the MODIS facility support team.

---

**Special Tilt Modes Required:**

---

**MODIS Team Member Proposal  
Data Requirements Form**

---

**Investigator:** Justice

---

**Output Product(s):** (1) Length of Growing Season  
(2) Semi-arid Biome Primary Production  
(3) Biomass Burning Trace Gas Emissions  
(supporting role)  
(4) Land Cover Change (supporting role to  
Strahler)

**Resolution (Time):**

**(Space):**

**Domain (Space):** global

---

**At/Post-Launch:** Post

---

**MODIS-N/T:** N

---

**Input Data:**

**Spectral Bands Required:** complete terrestrial 214m channels,  
nighttime mid-IR and thermal channels  
(5) 3.75 and 11um channels can detect  
fires, their state and size

**Resolution (Time):**

**(Space):** (4) 214 m (250 m) bands

---

**Ancillary Data Required (Type and Source):**

**Pre-Launch:**

**Size (Mbytes):**

(4) AVHRR 1 km data;  
TM data for tropical forests and  
arid lands  
5 TM/MSS pairs per year

**Post-Launch:**

**Size (Mbytes):**

(4) HIRIS data

---

---

Algorithm Complexity (floating point operations/scan):

---

Algorithm Memory Required (Mbytes):

---

Data Storage Required (Mbytes/scan):

---

Look-Up Tables Required:

Size (Mbytes):

---

Lines of Code:

---

Language Expected:

---

Accessory Output Products (e.g., field experiment data):

Pre-Launch:	Size (Mbytes):
-------------	----------------

Post-Launch:	Size (Mbytes):
--------------	----------------

---

Expected Need of SDST (Pre- or Post-Launch):

---

Post-Launch Expected Growth:

---

Quality Assessments:

---

Special Tilt Modes Required:

---



**MODIS Team Member Proposal  
Data Requirements Form**

---

**Investigator:** Huete

---

**Output Product(s):** Improved Vegetation Index

**Resolution (Time):** daily, weekly, monthly, seasonally, annually  
**(Space):** 1 km, 5 km, 10 km

**Domain (Space):** land - regionally and globally

---

**At/Post-Launch:** At

---

**MODIS-N/T:** N and T

---

**Input Data:** Level-2 topographically-corrected surface directional reflectances (preferably), Level-2 land-leaving radiances (secondarily), or Level-1b calibrated at-sensor radiances (if atmospheric correction models aren't operational at launch).

**Spectral Bands Required:** red and NIR (2 total)

**Resolution (Time):**

**(Space):** 1 km

---

**Ancillary Data Required (Type and Source):**

**Pre-Launch:**

Ground- and aircraft-based radiometer  
TM and AVHRR imagery

**Size (Mbytes):**

**Post-Launch:**

Ground control sites, HIRIS

**Size (Mbytes):**

---

---

**Algorithm Complexity (floating point operations/scan):**

---

**Algorithm Memory Required (Mbytes):**

---

**Data Storage Required (Mbytes/scan):**

600 megabytes per day at 1 km resolution

50 weekly products of 64 and 16 megabytes each (5 and 10 km products)

---

**Look-Up Tables Required:**

**Size (Mbytes):**

---

**Lines of Code:**

---

**Language Expected:**

---

**Accessory Output Products (e.g., field experiment data):**

**Pre-Launch:**

**Size (Mbytes):**

**Post-Launch:**

**Size (Mbytes):**

---

**Expected Need of SDST (Pre- or Post-Launch):**

---

**Post-Launch Expected Growth:**

---

**Quality Assessments:** Will be defined

---

**Special Tilt Modes Required:**

---

**MODIS Team Member Proposal  
Data Requirements Form**

---

**Investigator:** Huete

---

**Output Product(s):** (1) Spectral/temporal mixture model  
(2) Maps of spatial distribution and temporal dynamics of major terrestrial biomes  
(3) Soil brightness/color index  
(4) Day-night temperatures

**Resolution (Time):** (3) monthly  
(4) weekly

**(Space):** (2) Distribution of biomes on global scale  
Seasonal/interannual variations w/in individual biomes

**Domain (Space):** global and regional

**At/Post-Launch:** Post

---

**MODIS-N/T:** N and T

---

**Input Data:** (1) land-leaving radiances or directional reflectances in the 'color' bands of MODIS-N.  
Improved NDVI  
(3) Spectral mixture model

**Spectral Bands Required:** (2) 'color' bands of MODIS-T and visible and shortwave IR bands of MODIS-N

**Resolution (Time):**

**(Space):**

---

---

**Ancillary Data Required (Type and Source):**

<b>Pre-Launch:</b>	<b>Size (Mbytes):</b>
Ground- and aircraft-based radiometer data, in conjunction with TM imagery and AVHRR, will be used for algorithm development, validation studies, and conceptual modeling.	

<b>Post-Launch:</b>	<b>Size (Mbytes):</b>
Ground control sites, HIRIS	

---

**Algorithm Complexity (floating point operations/scan):**

---

---

**Algorithm Memory Required (Mbytes):**

---

---

**Data Storage Required (Mbytes/scan):**

---

---

**Look-Up Tables Required:**

<b>Size (Mbytes):</b>

---

**Lines of Code:**

---

---

**Language Expected:**

---

---

**Accessory Output Products (e.g., field experiment data):**

<b>Pre-Launch:</b>	<b>Size (Mbytes):</b>

<b>Post-Launch:</b>	<b>Size (Mbytes):</b>

---

**Expected Need of SDST (Pre- or Post-Launch):**

---

**Post-Launch Expected Growth:**

---

**Quality Assessments:** Will be defined

---

**Special Tilt Modes Required:**

---

**MODIS Team Member Proposal  
Data Requirements Form**

---

**Investigator:** Vanderbilt

---

**Output Product(s):** Polarized Vegetation Index

**Resolution (Time):** Quarterly, or monthly if feasible

**(Space):** 1 km, 10 km

**Domain (Space):** Regional to Global

---

**At/Post-Launch:** At

---

**MODIS-N/T:** N

---

**Input Data:** Level 1 (B), 2 (atmospherically corrected) and 3

**Spectral Bands Required:**

**Resolution (Time):**

**(Space):**

---

**Ancillary Data Required (Type and Source):**

**Pre-Launch:**

**Size (Mbytes):**

Simulated Polarized Vegetation Index  
Ground, aircraft (C-130 and ER-2), and  
shuttle polarized imaging measurements  
(radiance of ground and sky polarization)  
Simulated MODIS Level-1A(B), Level-2) and  
EOSP data  
-15 images in 1992 and 1993  
-50 images per year thereafter

**Post-Launch:**

**Size (Mbytes):**

EOSP data

---

---

**Algorithm Complexity (floating point operations/scan):**

---

**Algorithm Memory Required (Mbytes):**

---

**Data Storage Required (Mbytes/scan):** "Assuming a single byte integer adequately represents the PVI value of each pixel in an image, then each product covering the land area of the earth will require about 200 megabytes at 1 km resolution, or 2 megabytes at 10 km resolution."

---

**Look-Up Tables Required:**

**Size (Mbytes):**

---

**Lines of Code:**

---

**Language Expected:**

---

**Accessory Output Products (e.g., field experiment data):**

**Pre-Launch:**

**Size (Mbytes):**

**Post-Launch:**

**Size (Mbytes):**

---

**Expected Need of SDST (Pre- or Post-Launch):**

---

**Post-Launch Expected Growth:**

---

**Quality Assessments:**

---

**Special Tilt Modes Required:**

---

**MODIS Team Member Proposal  
Data Requirements Form**

---

**Investigator:** Zhengming Wan

---

**Output Product(s):** Land Surface Temperature

**Resolution (Time):** daily, weekly

**(Space):** 1 km or coarser (10km)

**Domain (Space):** Regional (Land Only)

---

**At/Post-Launch:** At

---

**MODIS-N/T:** N

---

**Input Data:**

**Spectral Bands Required:** Multiple (3) Thermal Bands in the 3-5  $\mu\text{m}$  region

**Resolution (Time):** 24 scenes/mo.

**(Space):**

---

**Ancillary Data Required (Type and Source):**

**Pre-Launch:**

**Size (Mbytes):**

Multiband thermal infrared data from:

Aircraft instruments: TIMS (2 flights  
per year for 2 or 3 yrs)

Existing satellites: AVHRR (48 scenes per yr.)

Field instruments: Field/lab spectral  
emissivity data with spectral resolution  
better than 0.1 $\mu\text{m}$  of a variety of land  
surface materials  
FIFE data

**Post-Launch:**

**Size (Mbytes):**

24 ITIR scenes/mo.,

6 HIRIS scenes/mo.,

6 SAR scenes/mo.

24 AMRIR scenes/mo.

Aircraft Instruments:



TIMS or similar data for some study areas,  
1-2 flights/yr. for 2-3 yrs. following.  
Field measurements: Modest field measurements  
and related field data from other EOS PIs.

---

Algorithm Complexity (floating point operations/scan):

---

Algorithm Memory Required (Mbytes):

---

Data Storage Required (Mbytes/scan):

---

Look-Up Tables Required:

Size (Mbytes):

---

Lines of Code:

---

Language Expected:

---

Accessory Output Products (e.g., field experiment data):

Pre-Launch:	Size (Mbytes):
-------------	----------------

Post-Launch:	Size (Mbytes):
--------------	----------------

---

Expected Need of SDST (Pre- or Post-Launch):

---

Post-Launch Expected Growth:

---

Quality Assessments: Will define.

---

Special Tilt Modes Required:

---

**MODIS Team Member Proposal  
Data Requirements Form**

---

**Investigator:** Zhengming Wan

---

**Output Product(s):** Land Surface Emissivity

**Resolution (Time):** daily, weekly

**(Space):** 1 km or coarser (10km)

**Domain (Space):** Regional (Land Only)

---

**At/Post-Launch:** Post

---

**MODIS-N/T:** N

---

**Input Data:**

**Spectral Bands Required:** Multiple (3) Thermal Bands in the 3-5  $\mu\text{m}$  region

**Resolution (Time):** 24 scenes/mo.

**(Space):**

---

**Ancillary Data Required (Type and Source):**

**Pre-Launch:**

**Size (Mbytes):**

Multiband thermal infrared data from:

Aircraft instruments: TIMS (2 flights per year for 2 or 3 yrs)

Existing satellites: AVHRR (48 scenes per yr.)

Field instruments: Field/lab spectral emissivity data with spectral resolution better than  $0.1\mu\text{m}$  of a variety of land surface materials

FIFE data

**Post-Launch:**

**Size (Mbytes):**

24 ITIR scenes/mo.,

6 HIRIS scenes/mo.,

6 SAR scenes/mo.

24 AMRIR scenes/mo.

Aircraft Instruments:

TIMS or similar data for some study areas,

1-2 flights/yr. for 2-3 yrs. following.  
Field measurements: Modest field measurements  
and related field data from other EOS PIs.

---

Algorithm Complexity (floating point operations/scan):

---

Algorithm Memory Required (Mbytes):

---

Data Storage Required (Mbytes/scan):

---

Look-Up Tables Required:

Size (Mbytes):

---

Lines of Code:

---

Language Expected:

---

Accessory Output Products (e.g., field experiment data):

Pre-Launch:	Size (Mbytes):
-------------	----------------

Post-Launch:	Size (Mbytes):
--------------	----------------

---

Expected Need of SDST (Pre- or Post-Launch):

---

Post-Launch Expected Growth:

---

Quality Assessments: Will define.

---

Special Tilt Modes Required:

---

**MODIS Team Member Proposal  
Data Requirements Form**

---

**Investigator:** Running

---

**Output Product(s):** (1) ET (evapotranspiration)  
(2) PSN (net photosynthesis)  
(3) ANPP (Annual net primary production)  
(4) Growing Season Length  
(5) Hydrological Balance

**Resolution (Time):** daily, weekly, and annual

**(Space):** 4 biomes

**Domain (Space):** global

---

**At/Post-Launch:** At

---

**MODIS-N/T:** N

---

**Input Data:** Level-2, NDVI, IPAR, weekly composited NDVI, day and night surface temperature, precipitation

**Spectral Bands Required:**

**Resolution (Time):**

**(Space):**

---

**Ancillary Data Required (Type and Source):**

**Pre-Launch:**  
AVHRR data

**Size (Mbytes):**

BIOME-BGC data requirements: Ground measurements from LTER (Long Term Ecological Research) sites including topography, isohyet maps, soil data, meteorological data, LAI. TM data for each LTER.

For algorithm development and validation: EarthInfo climate and hydrological data on compact disk, Matthews global vegetation data set on magnetic tape from NCAR, daily US AVHRR data on microfiche from EROS data center, AVHRR LAC data channels 1,2,4,5 day; channels 4,5 night from microfiche, weekly composited AVHRR GAC data, Biome canopy carbon and water conversion efficiencies and functions from BIOME-BGC.

<b>Post-Launch:</b>	<b>Size (Mbytes):</b>
canopy nutrition, trace gas fluxes and water stress from HIRIS	

---

**Algorithm Complexity (floating point operations/scan):**

---

**Algorithm Memory Required (Mbytes):**

---

**Data Storage Required (Mbytes/scan):**

---

**Look-Up Tables Required:**

<b>Size (Mbytes):</b>
-----------------------

---

**Lines of Code:**

---

**Language Expected:** FORTRAN

---

**Accessory Output Products (e.g., field experiment data):**

<b>Pre-Launch:</b>	<b>Size (Mbytes):</b>
LTER ground data	

<b>Post-Launch:</b>	<b>Size (Mbytes):</b>
LTER ground validation data sets	

---

**Expected Need of SDST (Pre- or Post-Launch):**

---

**Post-Launch Expected Growth:** Refinements of models, and input data products, development of products with Interdisciplinary Investigators.

---

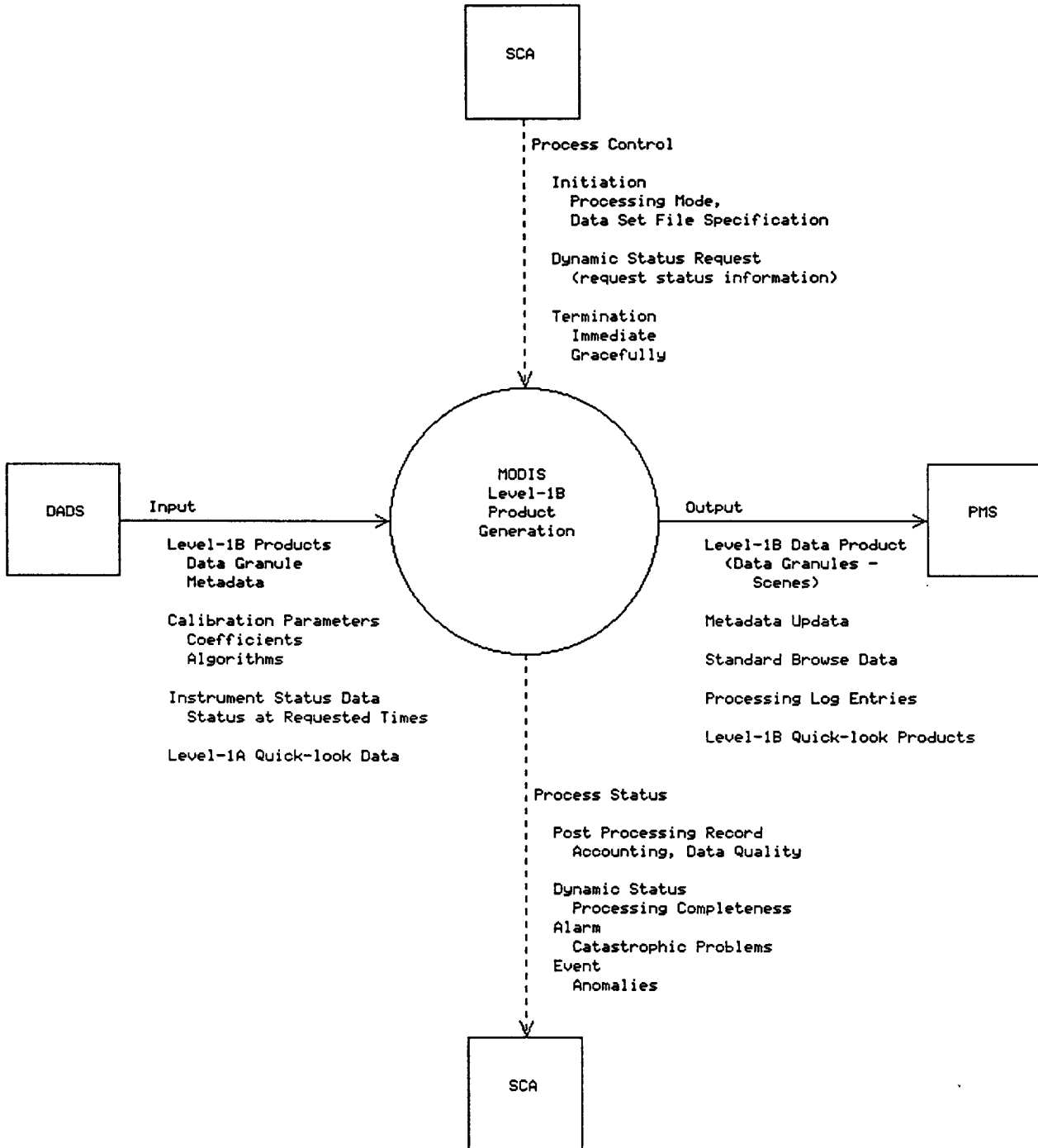
**Quality Assessments:**

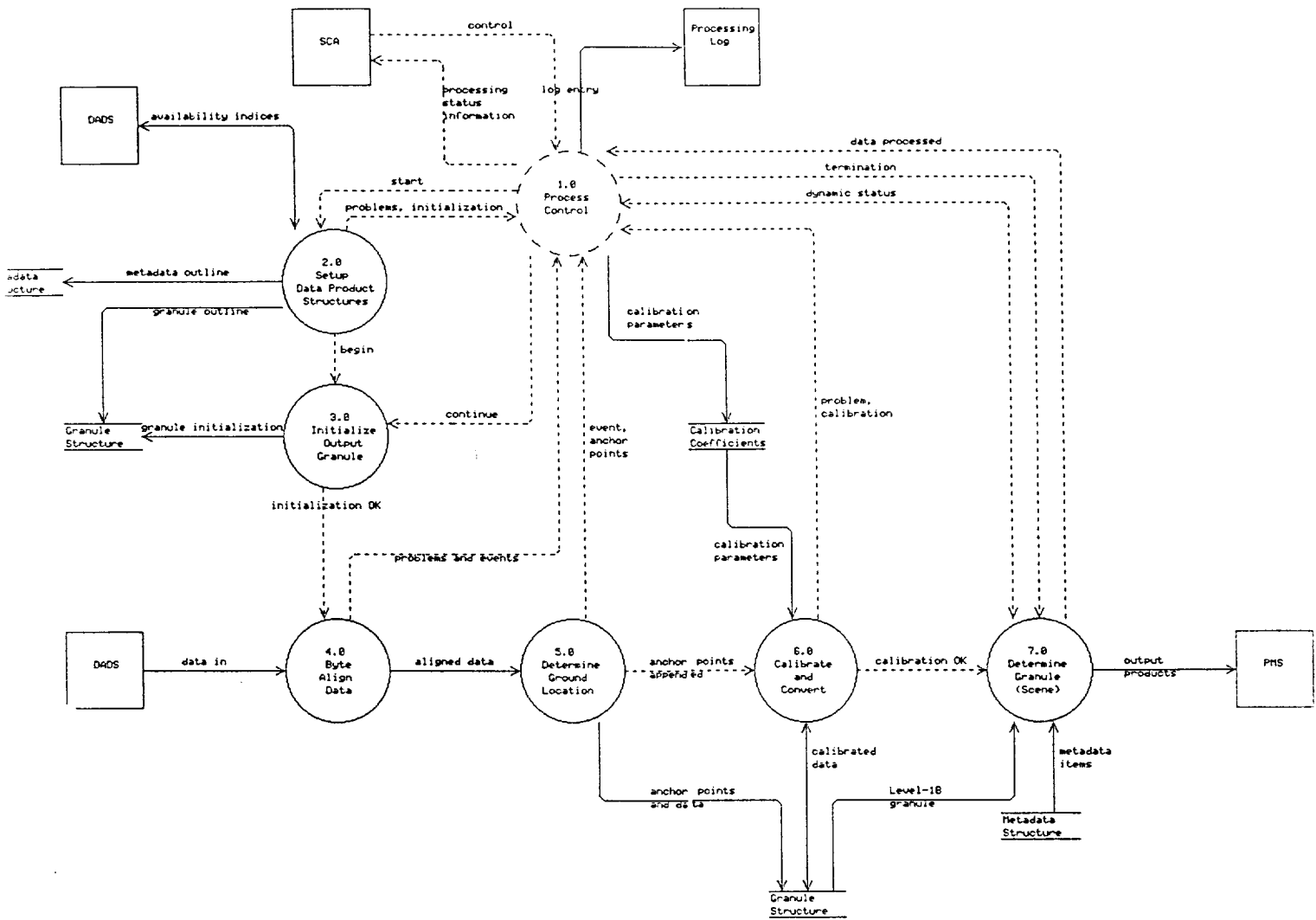
---

**Special Tilt Modes Required:**

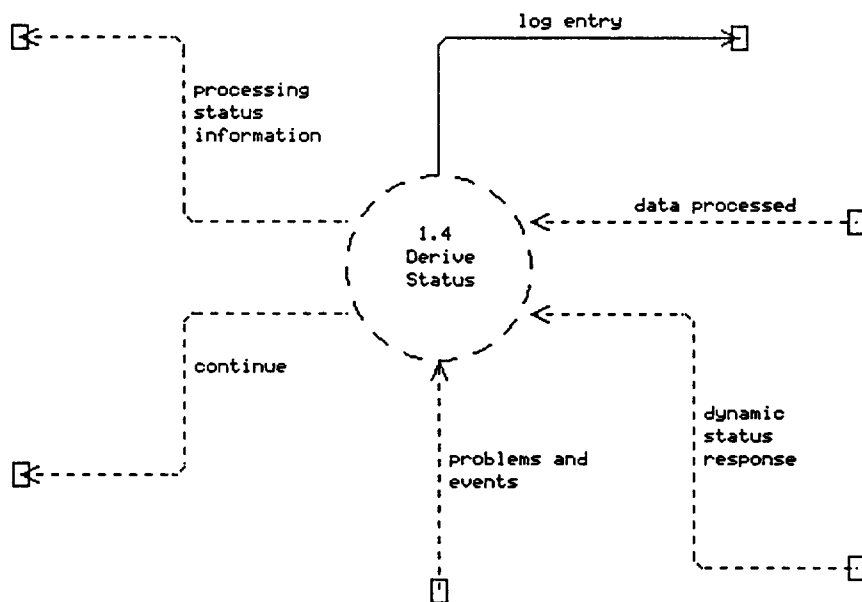
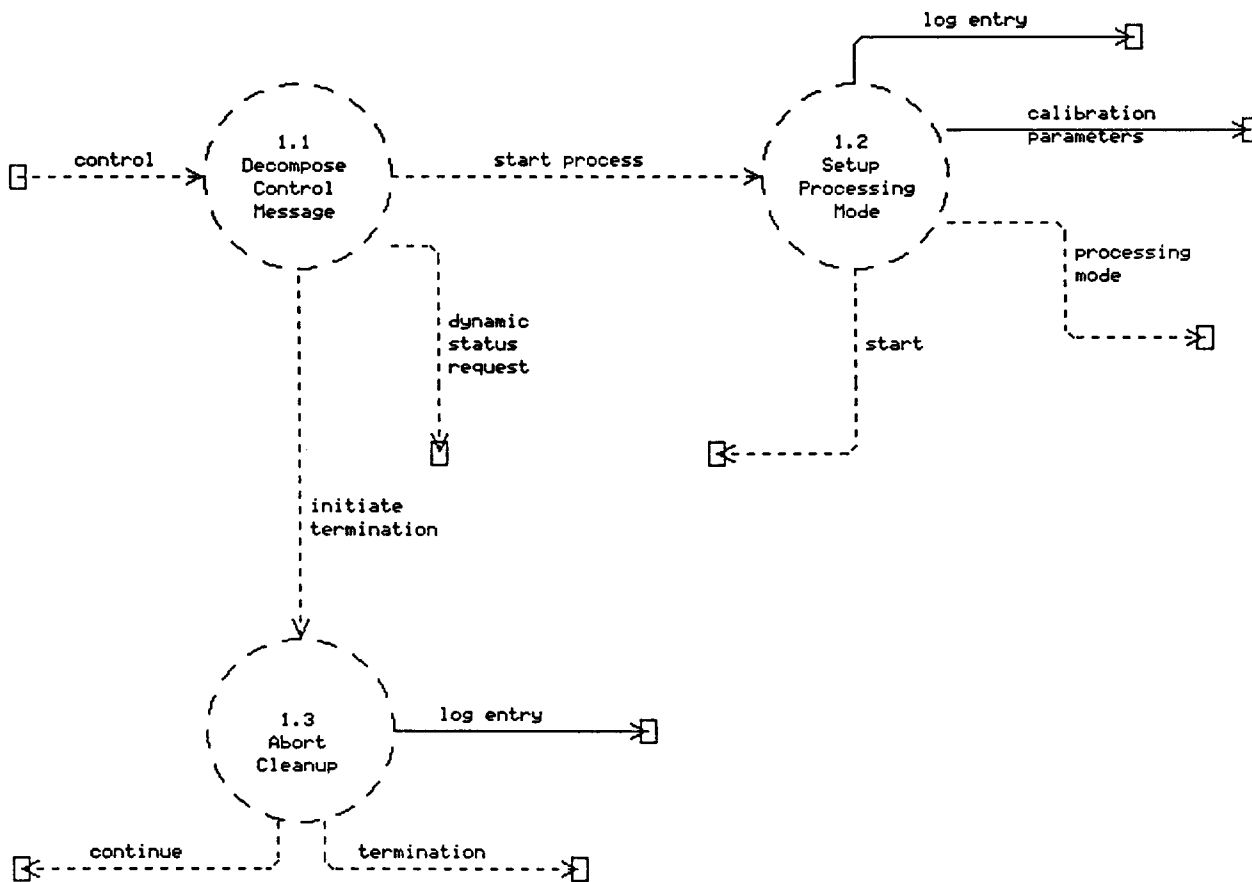
---

Project : \ECPLUS\MODIS-1B\  
Chart : context  
Filename : context.trg  
Last Modified : 01-31-1991



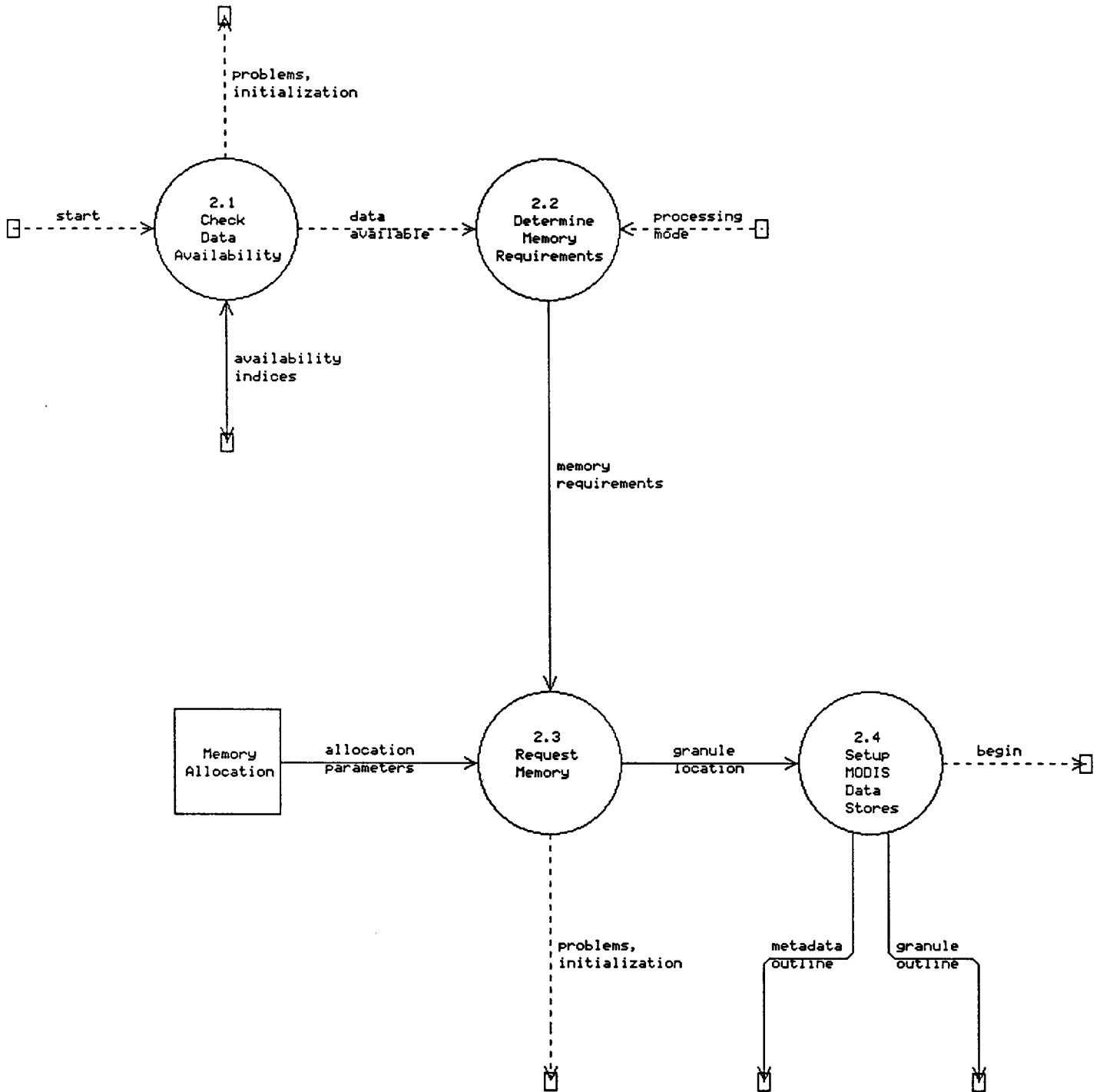


Project : \ECPLUS\MODIS-1B\  
 Chart : level-b1  
 File name : level-b1.trg  
 Last Modified : 01-31-1991

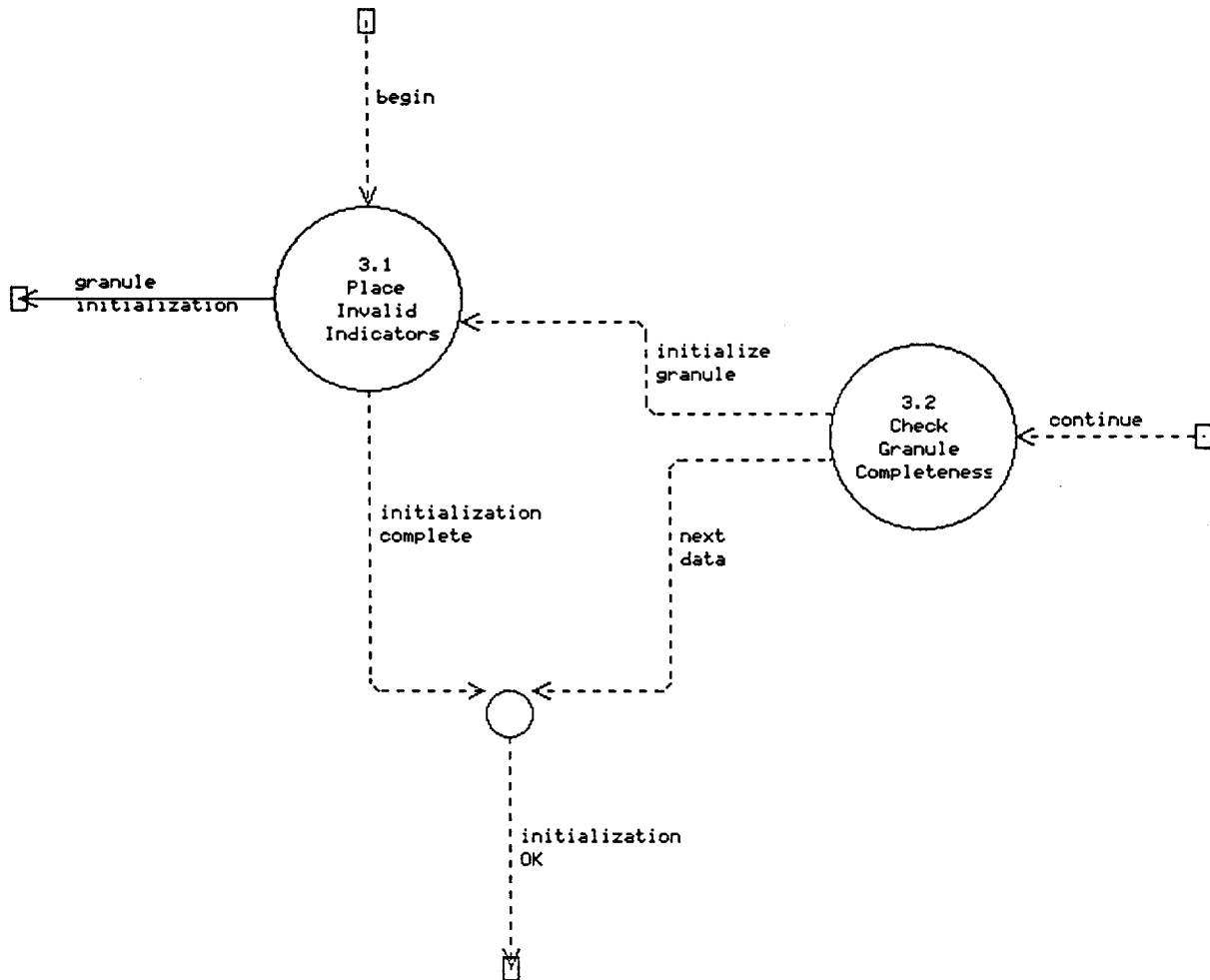


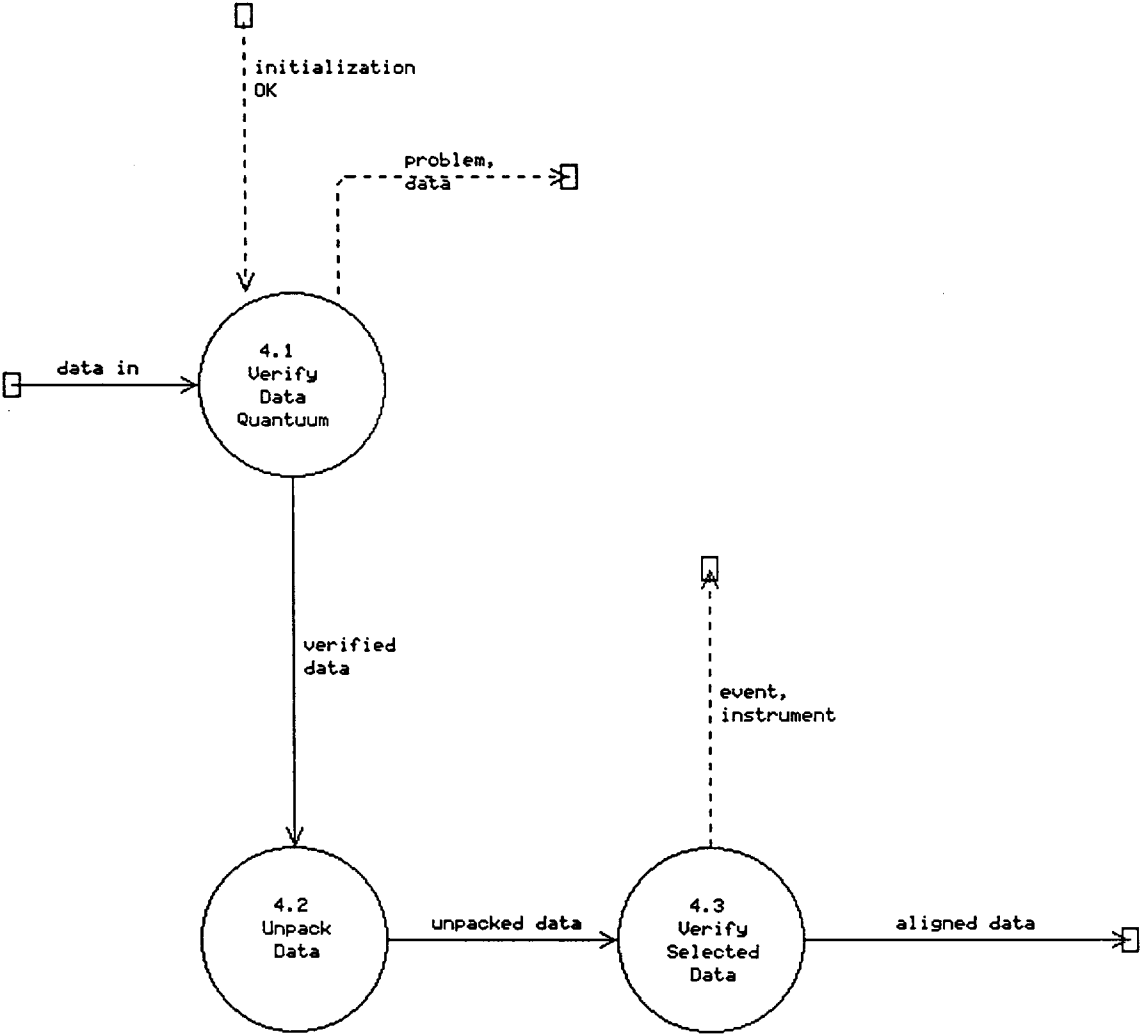


Project : \ECPLUS\MODIS-1B\  
Chart : level-b2  
Filename : level-b2.trg  
Last Modified : 01-31-1991



Project : \ECPLUS\MODIS-1B\  
Chart : level-b3  
Filename : level-b3.trg  
Last Modified : 01-31-1991





Project : \ECPLUS\MODIS-1B\

Data Dictionary Entry Description Attribute Report for Object Type = All  
 (\* indicates deleted DDE)

Object Identifier	Object Type	Description Attribute
Anchor Points Appended	Control Flow	An indication that the ground location anchor points have been appended to the granule (scene).
Begin	Control Flow	An indication to begin processing MODIS data.
Calibration OK	Control Flow	An indication that the MODIS data has been calibrated and converted to its final Level-1B format.
Continue	Control Flow	An indication to continue the processing of MODIS data.
Control	Control Flow	Messages from the EOSDIS scheduler containing start, finish, and requests for dynamic status.
Data Available	Control Flow	An indication that the data sets required to process the output granule(s) are available from the external database storage. This is expected to be in the form of database indices.
Data Processed	Control Flow	An indication that data has been processed and more data is needed. This also indicates the completion of a granule (scene) of data.
Dynamic Status	Control Flow	The request for and returning of dynamic status information.
Dynamic Status Request	Control Flow	A message originating via the SCA requesting that current processing information be posted into a return message. See Dynamic Status Response.
Dynamic Status Response	Control Flow	An internally generated message to be sent to the SCA that indicates the current status (accounting) of the data processing task. See also Dynamic Status Request.
Event, Anchor Points	Control Flow	An anomaly has occurred in the calculation of the anchor points. This may indicate an off Earth point, Moon looking point, illegal point, or a numerical problem.
Event, Instrument	Control Flow	An indication that an instrument event has been detected with a description of that event.
Initialization Complete	Control Flow	An indication that the output granule (scene) store has been initialized with invalid data indicators.
Initialization OK	Control Flow	An indication that the internal granule storage area has been initialized with invalid data indicators.
Initialize Granule	Control Flow	An indication to place the invalid data indicators into the output granule (scene) store.
Initiate Termination	Control Flow	An indicator to begin program execution termination. This may be either an abort-now (close files, deallocate memory) or

		graceful termination (post data before abort).
Next Data	Control Flow	An indication that the MODIS Level-1B program is ready for the next quantum of input data.
Problem, Calibration	Control Flow	An alarm indicating a serious problem in the calibration of the instrument. This may be a loss of calibration parameters, numerical problems, or out of bounds condition.
Problem, Data	Control Flow	An alarm that indicates that invalid MODIS Level-1A data has been received from the DADS.
Problems and Events	Control Flow	Any alarms or events that are to be detected at this Level-1B processing. This is probably a duplicate of the processing in the Level-1A program.
Problems, Initialization	Control Flow	An alarm message indication that a serious problem has occurred in the initialization of required store areas. This could be computer memory or disk memory.
Process Control	Control Flow	The SCA control of the initialization, dynamic status requesting, and termination of this program.
Process Status	Control Flow	The interface with the SCA consisting of Post Processing Status, Dynamic Status Response, Alarms, and Events.
Processing Mode	Control Flow	The mode of processing (standard, reprocessing, quick-look) with any size parameters required.
Processing Status Information	Control Flow	Information regarding the fault conditions and processing performance of this program. Status or completion information from the MODIS process to the SCA with a abnormal, dynamic, or normal termination information.
Start	Control Flow	An indication to start the processing of MODIS Level-1B data.
Start Process	Control Flow	The result of an "Initiate processing" message type being passed to this MODIS Level-1B program from the SCA.
Termination	Control Flow	An indication for the program to terminate immediately (abort) or gracefully (post remaining data). Either termination will cleanup and return any files or memory areas used to the operating system.
Abort Cleanup	Control Transform	Processes termination messages into the proper flow control items: either a graceful termination (all files written and closed) or abort-now condition (immediate termination without posting files). Posts an entry to the Processing Log.
Decompose Control Message	Control Transform	Decomposes the incoming message to determine the type of message and where to send it.
Derive Status	Control Transform	Handles problem (alarm) and event messages as well as data termination messages, posts entries to the Processing Log, and passes a Post Processing message to the SCA.
Process Control	Control Transform	Handles the control functions of this program.

		ogram. Accepts and sends control information to/from the SCA.
Setup Processing Mode	Control Transform	Derives the mode parameters, posts an entry to the system Processing Log, and starts the show.
Acquired Data	Data Flow	MODIS data that has been placed into a valid computer data word type.
Allocation Parameters	Data Flow	A request to the operating system for storage allocation and a response with the storage parameters or alternately, an error message.
Anchor Points and Data	Data Flow	A quantum of level-1A data, byte aligned and with ground located anchor points appended.
Availability Indices	Data Flow	An enquiry to and a response from the external database containing a map of the data set sizes and completeness that is used to determine if the MODIS Level-1B processing can be properly performed.
Calibrated Data	Data Flow	The data contained in the granule subset (quantum or scan cube) that is converted from instrument digital counts to the proper science or engineering dimensional units.
Calibration Parameters	Data Flow	Any data values or algorithms that are used to calibrate the instrument data.
Data In	Data Flow	Level-1A data products generated by the MODIS Level-1A program. This consists of the Level-1A data granule and the Level-1A Metadata.
Granule Initialization	Data Flow	Data values that initialize the internal granule store area to invalid data indicators.
Granule Location	Data Flow	The memory addresses and file names of the data stores.
Granule Outline	Data Flow	Address, sizes and types of the MODIS Level-1B granule store area. Initialization does not occur here.
Input	Data Flow	Consists of: Level-1A data or quick-look and locally maintained databases. (S/C ancillary data is included in the Level-1A data at this time.)
Level-1B Granule	Data Flow	The final processed MODIS Level-1B data granule.
Log Entry	Data Flow	A record to be posted in the EOSDIS (or other) master Processing Log. This provides an audit trail.
Memory Requirements	Data Flow	The derived size of the Level-1B storage areas needed to process the output granules (scenes) of data.
Metadata Items	Data Flow	The items in the Metadata structure that are updated or derived in this MODIS Level-1B program.
Metadata Outline	Data Flow	Addresses, sizes, and types of the metadata store allocation. This sets up the metadata memory area and initializes that area with Level-1A metadata values and additional predefined values representing invalid data.
Output	Data Flow	Consists of Level-1B products, Processing Log entries, Metadata, Browse data, an

Output Products	Data Flow	d/or quick-look products. MODIS Level-1B Products consisting of the data granules (scenes), enlarged Metadata, and Browse data. The products may be standard, reprocessed, or quick-look. The products can be either file names or file contents.
Unpacked Data	Data Flow	The input data quantum in an unpacked (byte aligned) form.
Verified Data	Data Flow	A MODIS Level-1A data quantum that has passed verification checks.
Byte Align Data	Data Process	Extract the data from the scan cube and byte/word align it. This places the data into a valid computer data type.
Calibrate and Convert	Data Process	Convert the raw counts data to their physical measurements. Science data to albedo or energy values, engineering data to temperatures, positions, rates, etc.
Check Data Availability	Data Process	Perform a verification that the data (MODIS Level-1B granule and Metadata) required to complete the output granule is available to this MODIS Level-1B program.
Check Granule Completeness	Data Process	Determine if the computer output granule store has been posted to disk and enable this store initialization if true.
Data Byte Alignment	Data Process	Input a quantum of Level-1A data, unpack the data into valid computer data words, and check for any instrument problems or anomalies that may have been overlooked in the Level-1A program.
Determine Granule (Scene)	Data Process	Perform final accounting at the output granule (scene) level. Create the granule header. Update or generate the metadata items. Transmit the data to the PMS. Deallocate memory and disc stores.
Determine Ground Location	Data Process	Determine the ground anchor points and append this data to the output granule.
Determine Memory Requirements	Data Process	Calculate the memory and disk size requirements, knowing the processing mode, number of output granules, or other parameters.
Initialize Output Granule	Data Process	Place invalid value indications into the output granule (scene) storage area in preparation for the next granule processing.
MODIS-1B Product Generation	Data Process	
Place Invalid Indicators	Data Process	Put invalid data value indicators into the predefined output granule (scene) store in computer memory. This provides an indication of granule completeness in the data granule without accessing the Metadata.
Request Memory	Data Process	Ask the operating system for system resources to allow the processing of this data set. This includes both computer memory and disk memory.
Setup Data Output Structures	Data Process	Setup the memory areas and the Output Data Product areas in computer memory and disk. Preallocate these data and metadata areas.
Setup MODIS Data Stores	Data Process	Determine all data stores. Initialize the

		e "yet to be determined" Metadata items to an invalid condition.
Unpack Data	Data Process	Unpack the 12 bits plus scaling bit into a computer recognizable data type. This is to be performed in place to minimize store area sizes.
Verify Data Quantum	Data Process	Ask for a quantum of MODIS Level-1A data and verify that a piece of valid data has been received. Generate a problem alarm if invalid data has been detected.
Verify Selected Data	Data Process	Perform any data value integrity tests. This may include items not visited in the Level-1A program in addition to newer items as defined during this processing level.
Calibration Coefficients	Data Store	Parameters used to calibrate both the engineering and the science data from the instrument. This includes any instrument characterization information.
Granule Structure	Data Store	The storage area for the data set granule (scene) containing a header with metadata values and instrument science and engineering data. Ancillary data such as calibration coefficients is also included.
Metadata Structure	Data Store	The storage area for the MODIS Level-1B metadata values.
DADS	External Entity	Data Archive and Distribution System. The EOSDIS core system program that manages the input and output product databases.
Memory Allocation	External Entity	An operating system memory (and disk) allocation routine. A process requests storage allocation and the system returns error or location parameters.
PMS	External Entity	Product Management System. Performs management of processed data, adds further data quality (metadata) information before passing the data to the DADS.
Processing Log	External Entity	Log of processing status records, time sequential events. This is not the current status, but a time based history of status events.
SCA	External Entity	Schedule, Control, and Accounting. An EOSDIS core system process that performs scheduling, control, and accounting of the various Product Generation System (PGS) programs.
context	trg	The MODIS Level-1B processing function context environment graph.
level-a	trg	
level-b1	trg	
level-b2	trg	
level-b3	trg	
level-b4	trg	
level-b5	trg	
*level-B2.trg	txt	